

Concordia, Missouri
Water Supply Study
E. A. PAPE LAKE

E. A. Pape Lake is located on a tributary to Blackwater River approximately 3 miles South of Concordia. Concordia is located in the Southeast corner of Lafayette County Missouri.

The record period of drought is the 1950's. Average annual rainfall is 37.2 inches. Annual rainfall for 1953 through 1957 is 24.1, 33.6, 39.4, 25.59, and 47.1 inches.

Two analysis were made:

1. First run was with the 2001 demand.
2. The lake was analyzed for the optimum daily use without emptying the lake during the evaluation period.

The 2001 demand was 0.494 million gallon per day.
Optimized demand is 0.839 million gallon per day.

Concordia Lake analysis consisted of using the NRCS's computer program "RESOP". This program analyses remaining stored water at the end of each month by summing gains and losses.

Following is the data and procedures for input to the "RESOP" program.

STO-AREA Elevation-Storage and Elevation-Area data were determined from June, 26, 2002 survey made by USGS.

E. A. Pape Lake

Elevation (feet)	Area (acres)	Storage (ac-ft)	
684.0	0.42	0.08	
686.0	4.71	3.28	
688.0	19.66	26.23	
690.0	32.74	78.18	
692.0	50.89	161.92	
694.0	70.71	281.88	
696.0	89.19	439.30	
698.0	111.02	639.15	
700.0	135.28	886.82	
702.1	156.02	1178.24	
704.0	179.15	1512.56	
706.0	205.59	1896.67	
708.0	238.20	2337.17	
709.3	261.55	2660.11	Water Surface on 6/26/2002
709.6	269.16	2740.18	Spillway Elevation

LIMITS Full Pool storage 2740 Ac.Ft.
Minimum Pool storage 60 Ac.Ft.

Starting storage was considered at full pool elevation.
The Drainage area of the lake is 8.48 Square Miles.

GENERAL The adjustment factor of 0.76 to convert from Pan evaporation to Lake evaporation was

applied prior to entering the data for the control word EVAP. As a result a factor of 100 was applied.

The record period of drought is in the 1950's.
Analysis began in January 1951 and ended December 1959.

SEEPAGE	The reservoir seepage varied from 0 seepage near empty to a maximum of 2.0 inch per month when at full pool. The material in the dam is compacted earth of clayey soils.
RAINFALL	Rainfall data came from the Lexington, Mo. rain gage for the period 1951 through 1959.
RUNOFF	<p>This is the runoff into the lake from its drainage area. Monthly runoff volumes in watershed inches were determined and comparisons were made for the Blackwater River Gage at Blue Lick, South Fork Blackwater River near Elm and Shiloh Creek near Marshall. The three gages yielded similar monthly runoff volumes with Shiloh Creek being the highest. However The Shiloh creek drainage has a higher percentage of cropland than the other gages and also Concordia Lake. The Blackwater River Gage was used for 1951 to June 1954, when data from South Fork Blackwater River near Elm became available and was used. The drainage area at the South Fork gage is 16.6 square miles. This gage is located upstream of Concordia. The soils and land use in the drainage area of the gage and the lake are similar.</p> <p>In cases where rainfall to runoff values did not appear reasonable, adjustments were made for that month by looking at individual rainfall events and estimating antecedent moisture and then, adjusting runoff based on NRCS's runoff curve numbers.</p>
EVAP.	Pan evaporation at the Lakeside gaging station was used as a base because it has data for year around evaporation. All other stations only measure data between April through November. Lakeside data was updated during these months with gage data from stations at New Franklin, and Columbia. Depending on the latest data for the station nearest to Concordia.
DEMAND	This was determined by city historical water use records. The total use in 2001 was 180,424,873 Gallons which amounts to 494,315 gallon per day.

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E. A. Pape Lake

Storage Volume

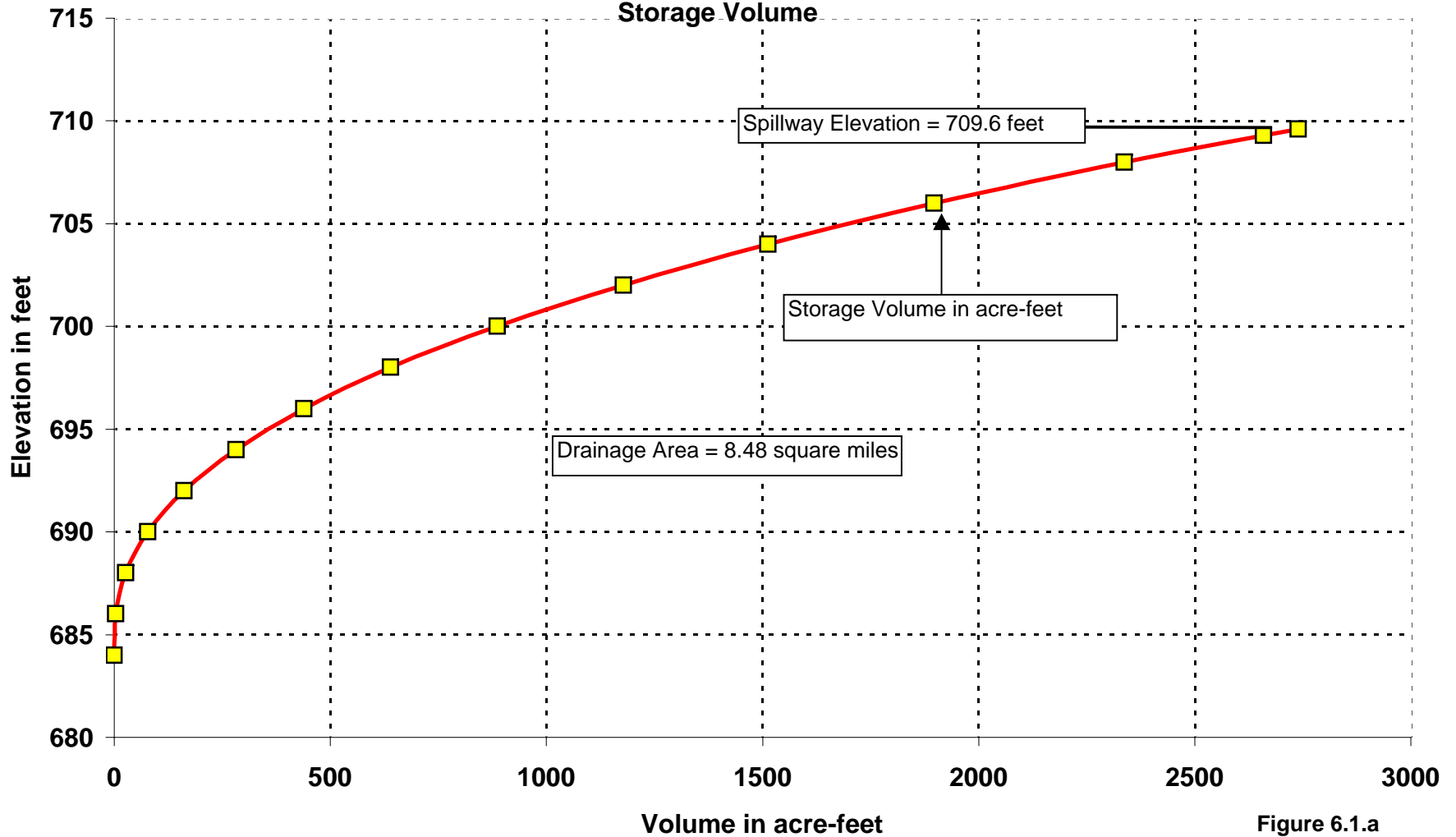


Figure 6.1.a

Concordia, Missouri
Water Supply Study
E. A. Pape Lake
Surface Area

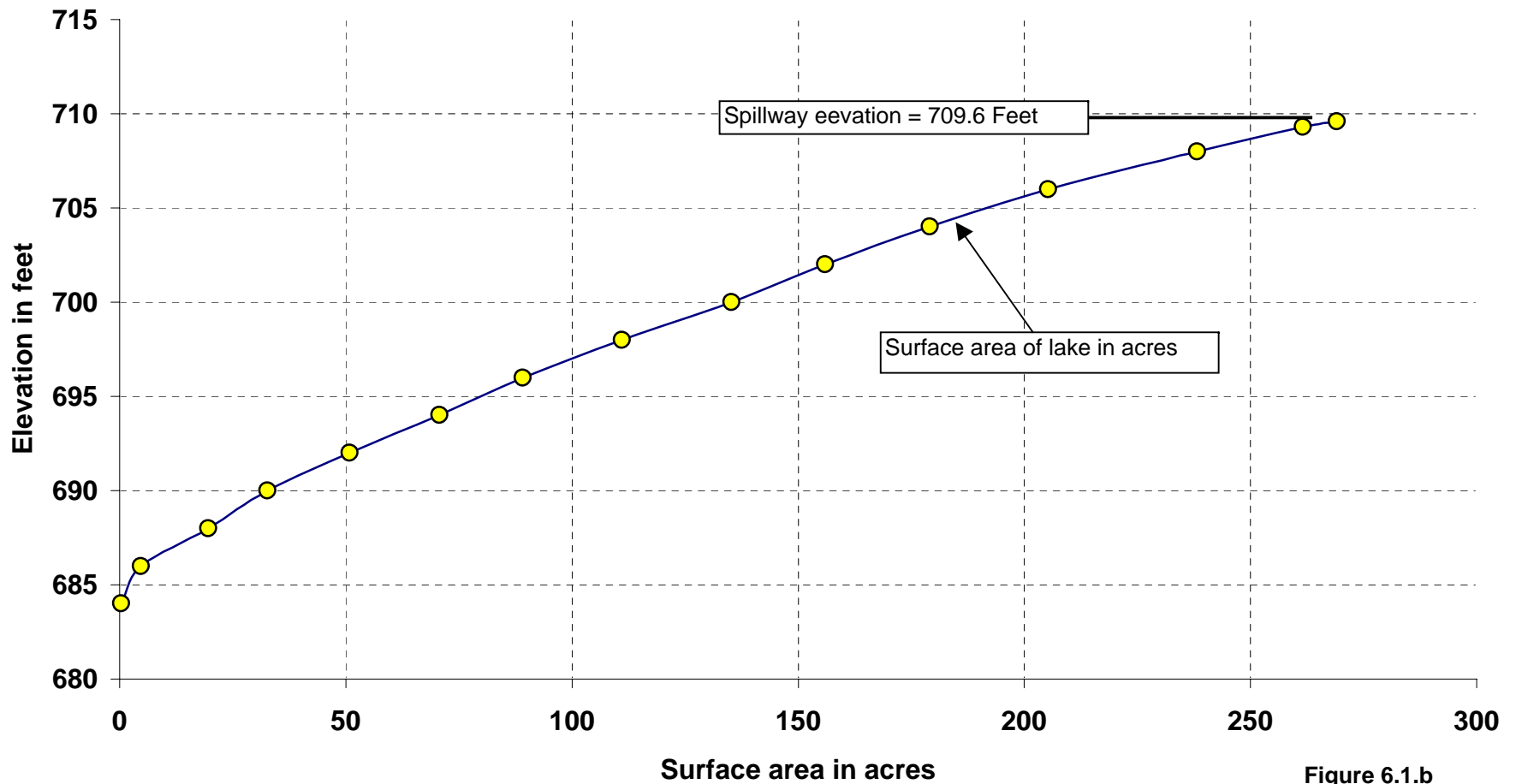


Figure 6.1.b

Concordia, Missouri
Water Supply Study
E.A. Pape Lake
Lake Storage

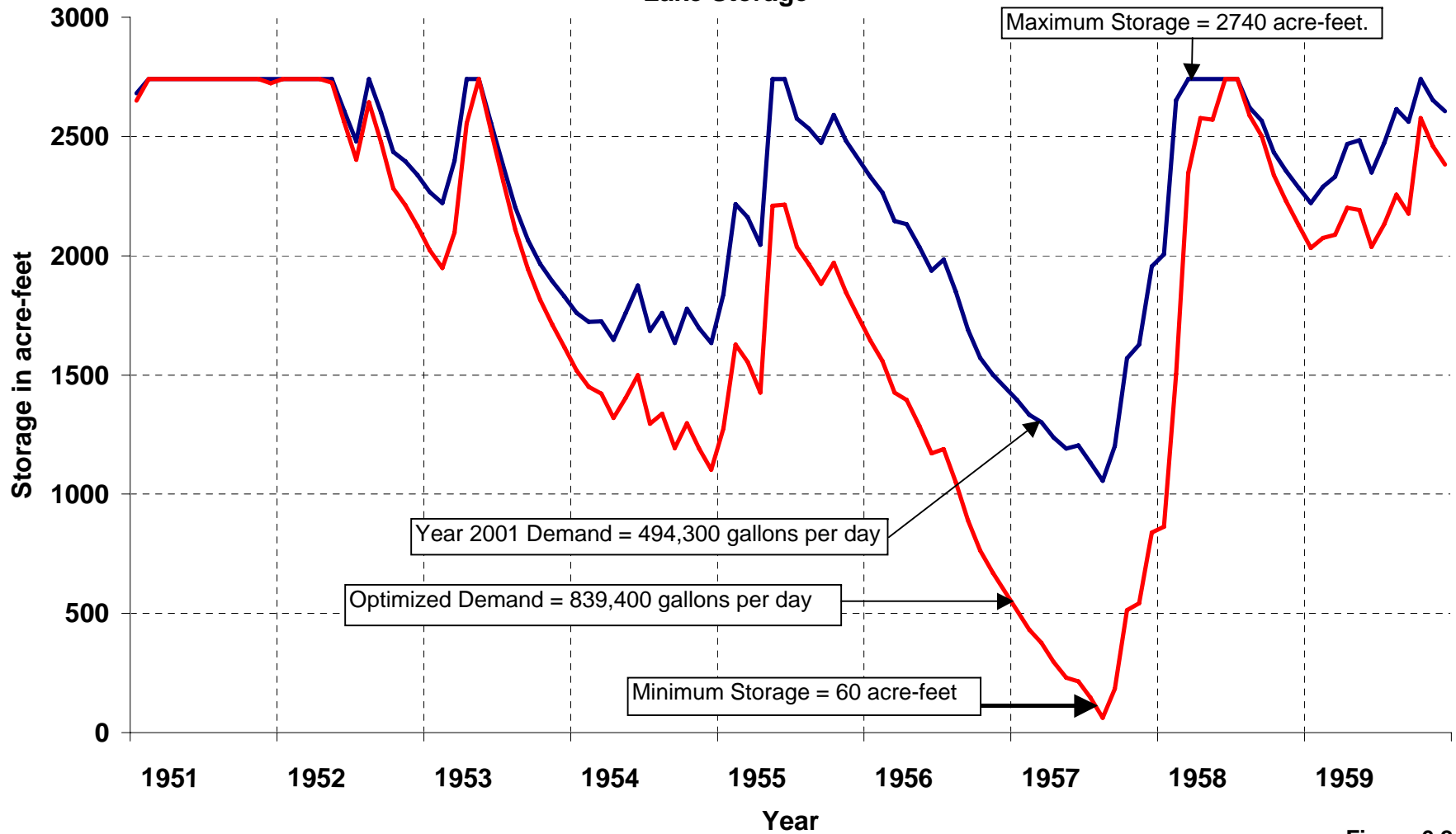


Figure 6.2

Concordia, Missouri

Water Supply Study

Water Use

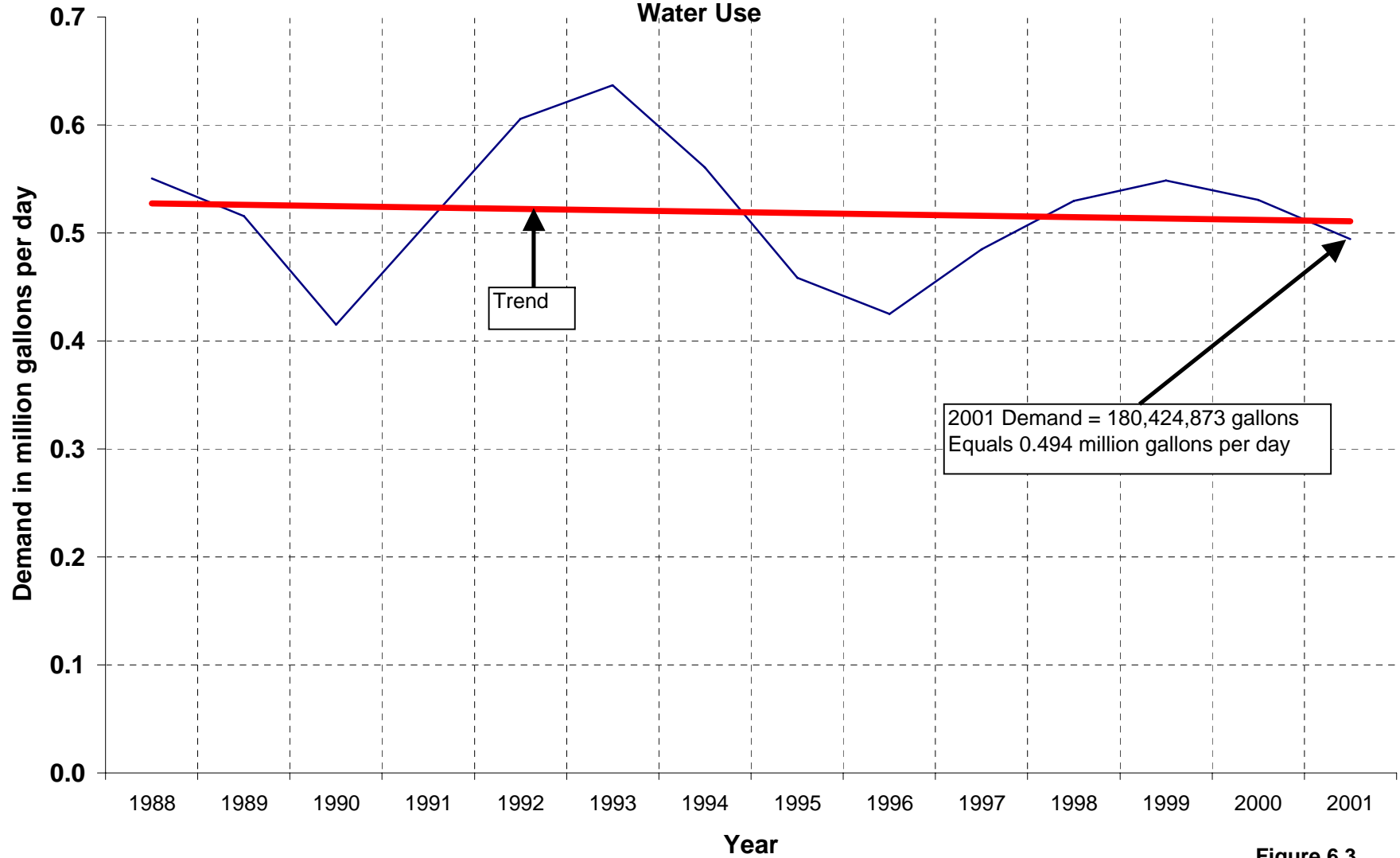
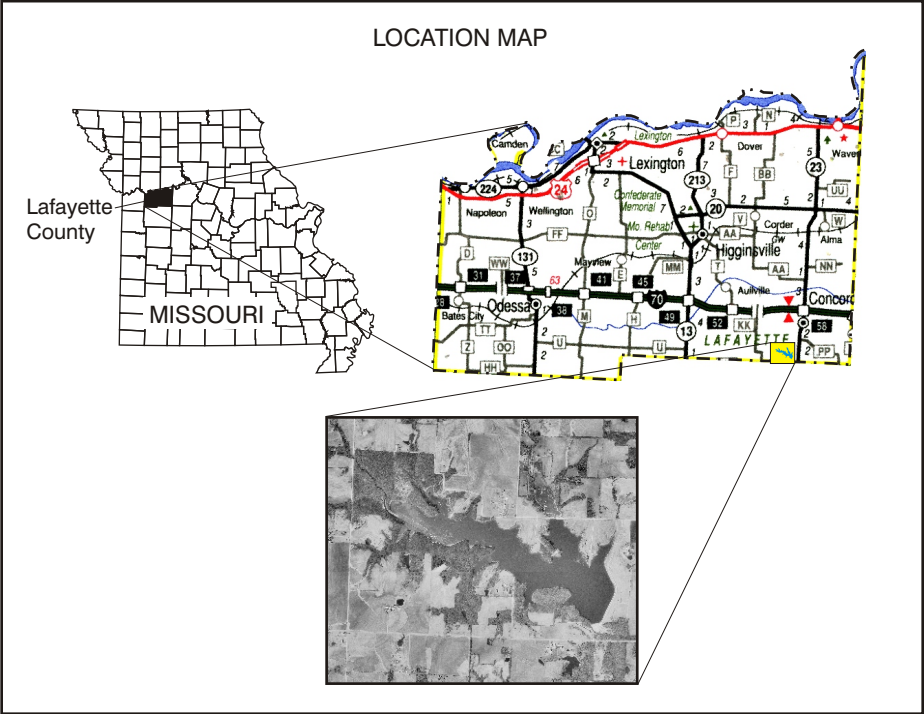
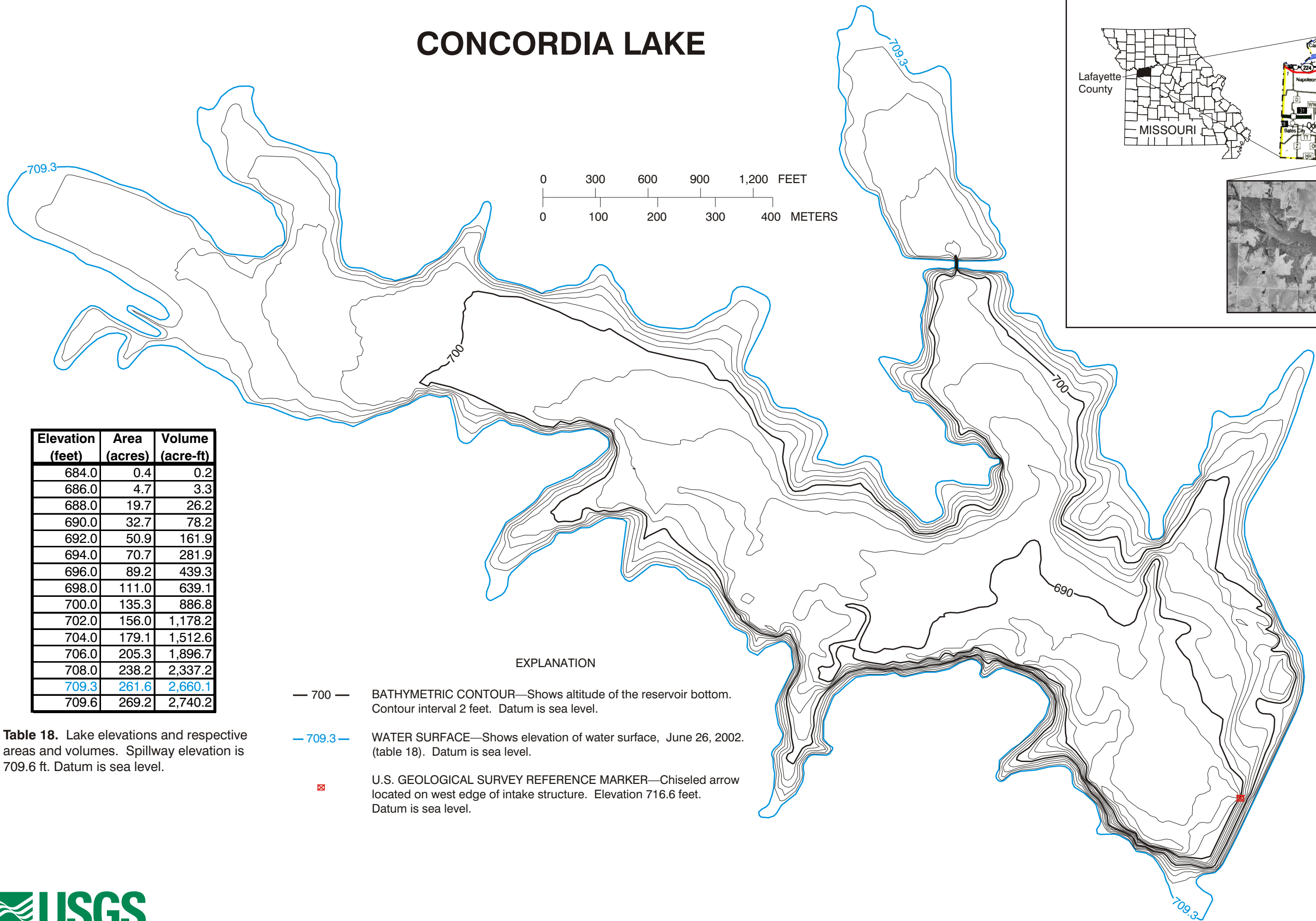


Figure 6.3

CONCORDIA LAKE



Elevation (feet)	Area (acres)	Volume (acre-ft)
684.0	0.4	0.2
686.0	4.7	3.3
688.0	19.7	26.2
690.0	32.7	78.2
692.0	50.9	161.9
694.0	70.7	281.9
696.0	89.2	439.3
698.0	111.0	639.1
700.0	135.3	886.8
702.0	156.0	1,178.2
704.0	179.1	1,512.6
706.0	205.3	1,896.7
708.0	238.2	2,337.2
709.3	261.6	2,660.1
709.6	269.2	2,740.2

Table 18. Lake elevations and respective areas and volumes. Spillway elevation is 709.6 ft. Datum is sea level.

- EXPLANATION**
- 700 — BATHYMETRIC CONTOUR—Shows altitude of the reservoir bottom. Contour interval 2 feet. Datum is sea level.
 - 709.3 — WATER SURFACE—Shows elevation of water surface, June 26, 2002. (table 18). Datum is sea level.
 - ☒ U.S. GEOLOGICAL SURVEY REFERENCE MARKER—Chiseled arrow located on west edge of intake structure. Elevation 716.6 feet. Datum is sea level.

Figure 18. Bathymetric map and table of areas/volumes of the Concordia Lake near Concordia, Missouri.